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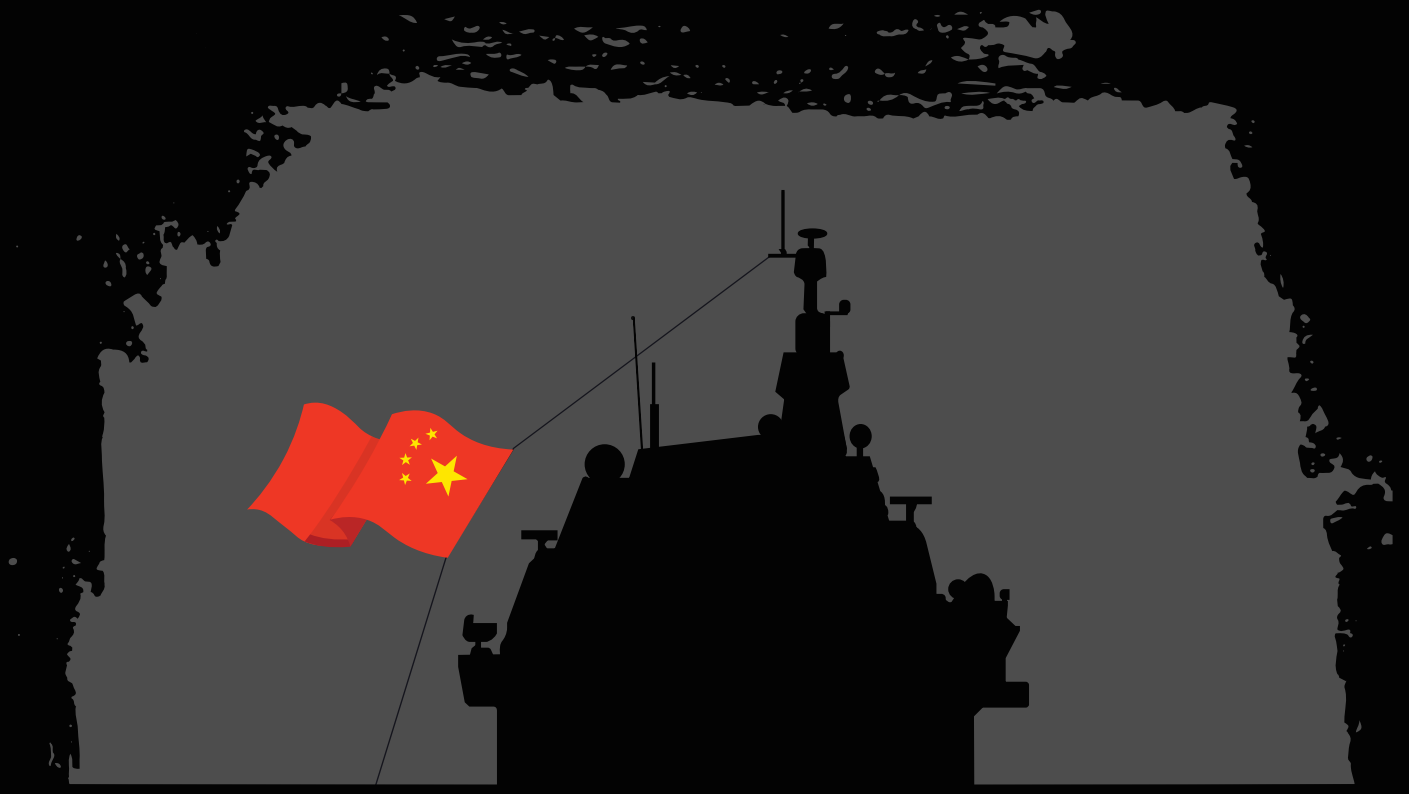

Bridges Over Troubled Waters:

Shuiqiao-Class Landing Barges in PLA Navy Amphibious Operations

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CMSI NOTE #14 /// 20 March 2025

Bridges Over Troubled Waters:
Shuiqiao-Class Landing Barges in PLA Navy Amphibious Operations

J. Michael Dahm[1] **and Thomas Shugart**[2]

In January 2025, news emerged from China of specialized barges that support People's Liberation Army (PLA) requirements for over-the-shore logistics, such as during an amphibious assault on Taiwan.[3] This purportedly sudden PLA capability development has been decades in the making. Dubbed "*Shuiqiao*" by analysts, these self-propelled jack-up barges, each with a telescoping "Bailey bridge," link together to form a composite 820-meter (2690 foot) relocatable pier (Figures 1 & 2). This relocatable pier system can deliver large volumes of equipment and materiel into unimproved amphibious landing areas, damaged or blocked ports, or possibly across seawalls or other obstacles onto coastal roads. With a total of five points at which to dock roll-on/roll-off (RO-RO) ships, the relocatable pier could potentially transfer hundreds of vehicles ashore per hour. Despite this significant supporting role, these landing barges are probably too vulnerable to spearhead an amphibious invasion of Taiwan. Even so, in the context of rapidly expanding military capabilities and infrastructure across the PLA, this newest logistics capability is further evidence of the PLA's efforts to meet Chairman Xi Jinping's reported mandate to have military capabilities necessary to conduct a large-scale invasion of Taiwan by 2027.

Figure 1. Three *Shuiqiao* class LPU Relocatable Pier Configuration (March 2025 near Zhanjiang, China (*Weibo*)[4]

Figure 2. Three *Shuiqiao* class LPU Relocatable Pier Configuration (March 2025 near Zhanjiang, China (*WeChat*)[5]

CMSI's Perspectives and Key Takeaways

- The China State Shipbuilding Corporation (CSSC) Offshore & Defense Engineering Company (COMEC) has developed three specialized self-propelled landing barges that link together to form an 820-meter (2690 foot) composite relocatable pier.[6]
- In early March 2025, the first set of three barges conducted sea trials and formed a relocatable pier on a beach near Zhanjiang, Guangdong, in southern China (Figures 1 & 2).
- A second, identical set of three landing barges is still under construction in southern China.
- Analysts have dubbed this class of barge "*Shuiqiao"* (literally "water bridge" (水桥) in Chinese),[7] tentatively categorizing it as "landing platform utility" (LPU).[8]
- Based on their function, paint scheme, and lack of Automatic Identification System (AIS) transmissions, the barges are very likely PLA Navy auxiliaries and not civilian vessels.
- Three types of landing barges with extendable "Bailey bridges" may be classified by their length in meters: *Shuiqiao-110*, *Shuiqiao-135*, and *Shuiqiao-185* class LPUs.[9]
- The landing barges are the latest in a series of rapidly evolving capabilities that significantly improve the PLA's ability to conduct over-the-shore logistics in a Taiwan invasion scenario.
- While these landing barges help address a critical PLA requirement, they may create additional problems for the PLA in terms of amphibious landing throughput. That is, the potential volume created by the barges may result in challenges moving equipment and materiel *out* of a landing area in highly restricted and potentially contested terrain on Taiwan.
- Considering these landing barges in the context of other developments related to amphibious operations suggests the PLA may have significantly advanced its timetable to have sufficient capabilities to conduct a large-scale cross-strait operation against Taiwan in accordance with Xi Jinping's 2027 centennial military building goal (建军一百年奋斗目标).

Context

China's *Shuiqiao* LPUs address a critical PLA requirement to move large volumes of personnel, equipment, and materiel into amphibious landing areas or damaged ports. Immediately following a successful assault spearheaded by PLA Army (PLAA) amphibious armored brigades and/or PLAAF airborne troops, the PLA must quickly establish what they call an "amphibious landing base" (两栖登陆基地) to deploy the at-sea component of the "transportation and projection force" (运输投送力量). The maritime transportation and projection force moves second echelon troops, heavy equipment, and logistics materiel from military and civilian ships into secured beachheads and captured ports.[10]

Joint logistics over-the-shore, or "JLOTS," is a U.S. term for the loading and unloading of ships in austere areas where port facilities are damaged, unavailable, or inadequate for operations.[11] While the PLA has not adopted U.S. military JLOTS terminology, they have written extensively about how to conduct logistics for an amphibious operation. Chinese terms more typically associated with these operations include 人工港 (artificial port) and 无码头卸载 ("no-dock," or "dockless" unloading).[12]

While PLA offshore landing capabilities have evolved rapidly in recent years, the development of the *Shuiqiao* LPUs has been in the works for almost a quarter-century. In 2001, China's National Defense

Mobilization Committee ordered the development of an "offshore mobile unloading platform," a major effort under "Project 019" (019 工程). China's Military Transportation Research Institute (军事交通研究所) was tasked to develop a prototype offshore unloading platform to create a capability for at-sea transfer and unloading of vehicles and materiel when ports had been destroyed by enemy forces.[13]

The PLA did eventually develop a rudimentary floating causeway system that appears to have been based on the U.S. Navy Improved Navy Lighterage System (INLS).[14] That system first debuted on Chinese television in 2014.[15] In 2020, PLA authors publicly acknowledged shortcomings and underinvestment in military over-the-shore logistics capabilities.[16] That same year, the PLA and its Joint Logistics Support Force (JLSF) began focusing on over-the-shore logistics development. In summer 2020, the JLSF conducted a large-scale exercise that introduced an improved floating causeway and integrated civilian RO-RO and cargo ships with innovative concepts for unloading ships offshore.[17]

The PLA introduced a new, self-propelled floating causeway in 2021, and in 2022 it had made improvements that extended the original pier by 40 percent to 650 meters (2130 feet).[18] However, the improved floating causeway system saw only limited use in 2023 exercises.[19] The new causeway was not used in the PLA's annual amphibious landing capstone exercise in 2024 and sat idle at the PLA's Qinying'ao Amphibious Base for most of the year. The limited use of the causeway system may indicate technical issues with the floating system, especially in light of U.S. Army challenges with a similar temporary pier system that broke apart off the coast of Gaza in 2024.[20]

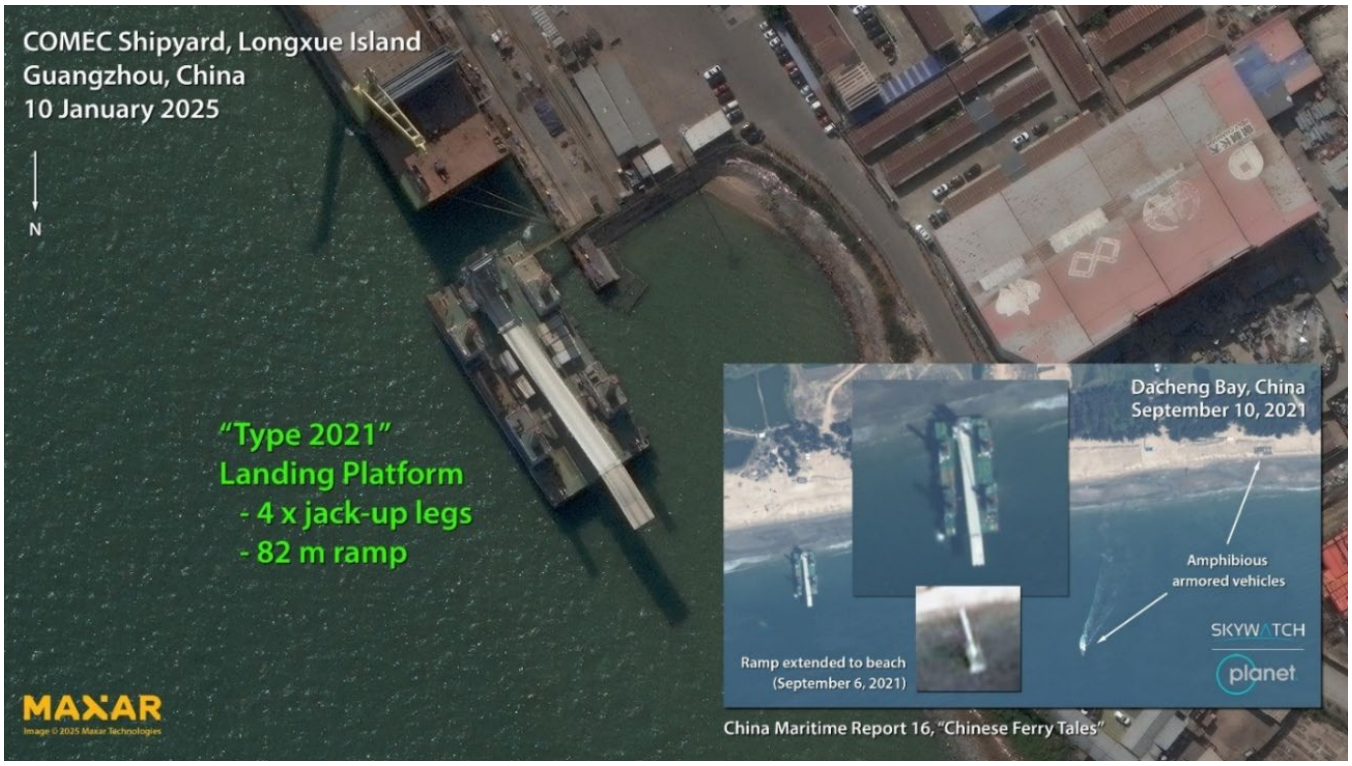

Figure 3. "Type 2021" Prototype LPU (© 2025 Maxar Technologies)[21]

PLA amphibious exercises in 2021 saw experimentation with a new type of landing platform that featured four jack-up legs to stabilize the platform near shore and an 82-meter ramp that extended to the beach. This platform (which we call the "Type 2021 Landing Platform" in the absence of a known PLA

designation) was probably a prototype for the *Shuiqiao* LPUs. The platform was present at the COMEC Longxue shipyard in January 2025 (Figure 3).

CSSC subsidiary Emergency Warning and Rescue Equipment Co., Ltd. (应急预警与救援装备股份有限公司), also known as China Harzone, may have had a significant role in the development and construction of the landing barges. Harzone is China's leading designer and manufacturer of "emergency traffic engineering equipment" and supplies the PLA with virtually all of its mobile bridging equipment and a range of pre-fabricated Bailey trestle bridges. Other combat engineering equipment offered by China Harzone includes truck-deployed mobile railway platforms, fast road pavers to lay a hard surface over sand and mud, and substantial pontoon bridges for crossing rivers.[22] Harzone probably had a role in the development of the PLA's floating causeway featured in amphibious exercises since 2020.[23] A Harzone work report indicated that a "certain landing bridge" (某型登陆栈桥) had successfully completed sea trials in 2021 although it was not clear from this brief reference whether the "landing bridge" in question referred to the floating causeway or the previously mentioned "Type 2021 Landing Platform."[24]

In December 2021, China Harzone applied for a patent for "a special work boat capable of rapidly erecting bridge spans." The application was fast-tracked for approval by mid-2022. The patent describes a jack-up barge with four legs and a Bailey bridge that can deploy forward or aft of the barge. Like the *Shuiqiao* LPUs, the patented boat design envisioned using several of these boats together to form a relocatable pier several hundred meters long (Figure 4).[25]

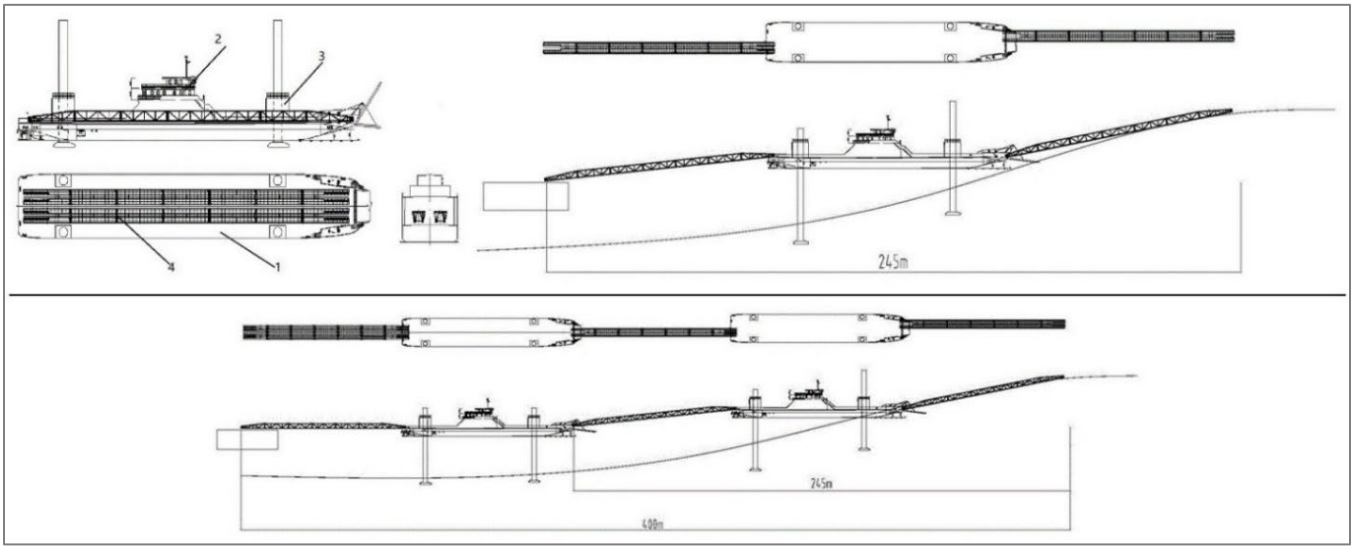

Figure 4. China Harzone 2021 Patent Drawings of a Landing Barge

Whatever CSSC's Harzone subsidiary may have contributed, it appears that CSSC supercharged the landing barge idea with offshore oil and gas industry technology in developing the *Shuiqiao* LPUs. The *Shuiqiao-185* design appears to borrow from other patents and design technologies such as those proposed in 2020 by Shanghai Honghua Offshore Oil & Gas Equipment Corporation for a rapidly erected, bottom resting relocatable pier (Figure 5).[26] This and other oil and gas industry designs for substantial nearshore and offshore platforms likely mean the *Shuiqiao* LPUs have incorporated trusted, reliable technologies in their design.

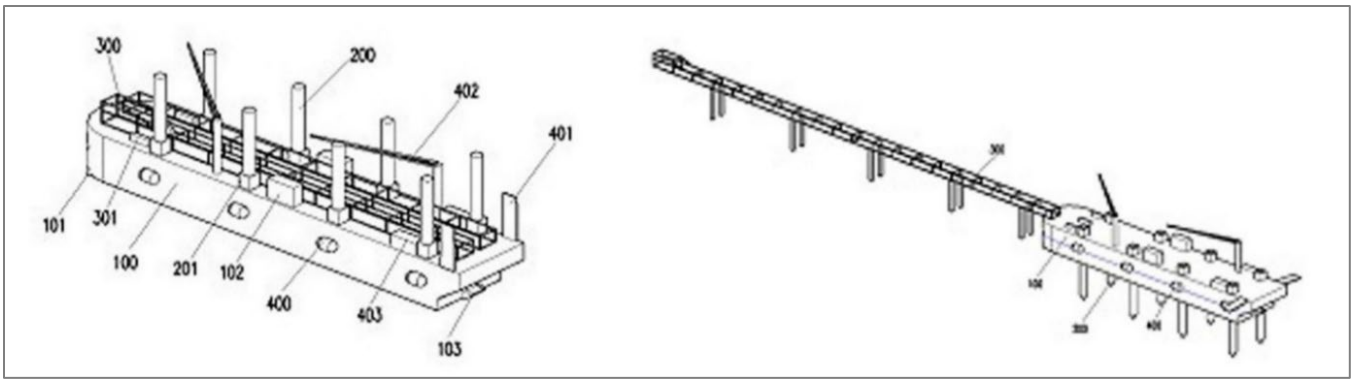

Figure 5. Shanghai Honghua 2020 Patent Drawing for a Relocatable Pier

CSSC subsidiary Offshore & Defense Engineering Company (COMEC) offered the PLA perhaps an ideal intersection of offshore technology innovation and China's defense industry to build the first set of LPUs. That said, there are any number of Chinese shipyards that are capable of building LPU-sized vessels. These shipyards could conceivably participate in a building campaign to rapidly construct LPUs in the months leading up to a large-scale cross-strait operation.

Shuiqiao **Class LPU Design**

January 2025 commercial satellite imagery of the COMEC Longxue Island shipyard revealed two sets of three *Shuiqiao* LPUs under construction. One set of three barges appeared substantially complete while the other set of three was still in their graving docks. (Figure 6). The *Shuiqiao* LPUs may be classified by hull length. *Shuiqiao-110* is 110 x 38 meters (361 x 125 feet) (Figure 7). *Shuiqiao-135* is 135 x 36 meters (443 x 118 feet) (Figure 8). *Shuiqiao-185* is 185 x 36 meters (607 x 118 feet) (Figure 9).

Figure 6. COMEC Shipyard, Longxue Island, China, 10 January 2025 (© 2025 Maxar Technologies)[27]

Figure 7. *Shuiqiao-110* Class LPU, 10 January 2025 (© 2025 Maxar Technologies)[28]

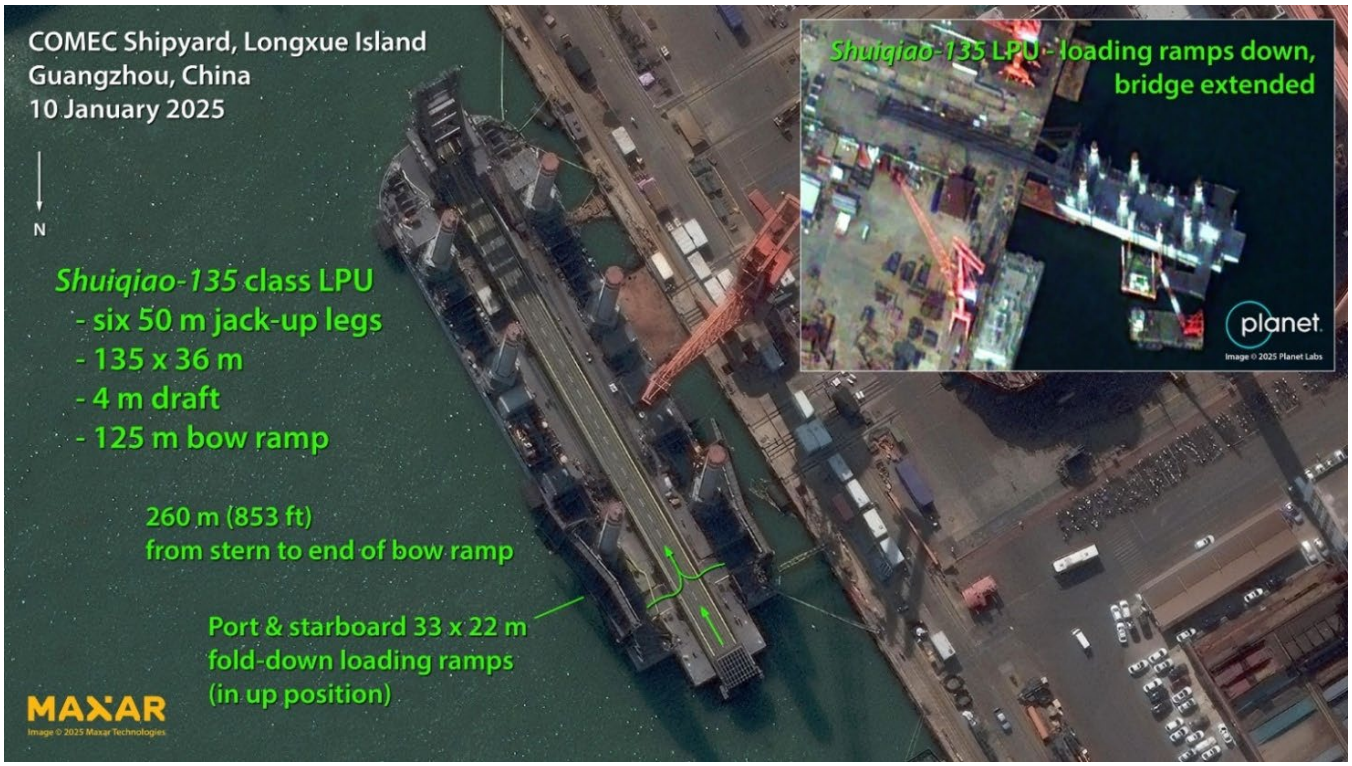
COMEC Shipyard, Longxue Island
Guangzhou, China
10 January 2025
N
Shuiqiao-135 class LPU
- six 50 m jack-up legs
- 135 x 36 m
- 4 m draft
- 125 m bow ramp
260 m (853 ft)
from stern to end of bow ramp
Port & starboard 33 x 22 m
fold-down loading ramps
(in up position)
Shuiqiao-135 LPU - loading ramps down, bridge extended
planet
Image © 2025 Planet Labs
MAXAR
Image © 2025 Maxar Technologies

Figure 8. *Shuiqiao-135* Class LPU, 10 January 2025 (© 2025 Maxar Technologies, © 2025 Planet Labs)[29]

The LPUs appear to have very shallow drafts in order to operate close to shore. Based on photographic analysis, the smallest LPU, the *Shuiqiao-110*, has a draft of probably 2 m (6 ft) or less and appears shallower at the bow to allow it to get closer to shore. Associated patents suggest the *-110* can also flood its aft ballast tanks to raise the bow of the ship to beach itself in even shallower water if necessary. The *Shuiqiao-135* and *-185* appear to have more substantial drafts of perhaps 4 m (13 ft).

The *Shuiqiao-135* and *-185* LPUs have fold down ramps to accommodate RO-RO ships berthing alongside these two LPUs that are positioned farther offshore. In addition to civilian RO-RO ships supporting the PLA, the ramps could also accommodate amphibious landing ships such as Type-072 LSTs.[30] Satellite and handheld images show large bumpers or fenders on either side of the barges to prevent ships moored alongside the LPUs from colliding. The *Shuiqiao-135* has L-shaped ramps that fold down from the port and starboard sides with interior ramps that go to the upper bridge deck.

The *Shuiqiao-185* has the same type of L-shaped ramp on the starboard side of the barge, but it also has a large fold-down stern ramp that can likely accommodate a RO-RO ship docking directly behind the barge. The *-185* LPU stern ramp has a unique angled shape on its port side. This protrusion may accommodate a RO-RO vessel mooring perpendicular to the barge or accommodate large RO-RO vehicle carriers that have distinctive angled loading ramps (Figure 10). Large vehicle carriers are typically around 170 meters in length—easy for the *Shuiqiao-185* to take alongside. The PLA has previously demonstrated the use of commercial RO-RO vehicle carriers to move large numbers of military vehicles, including tanks.[31] Previous PLA floating causeway designs could not accommodate large RO-RO vehicle carriers due to their size, deep draft, and angled ramp, making this new temporary pier system a significant addition to the PLA's logistics capability.

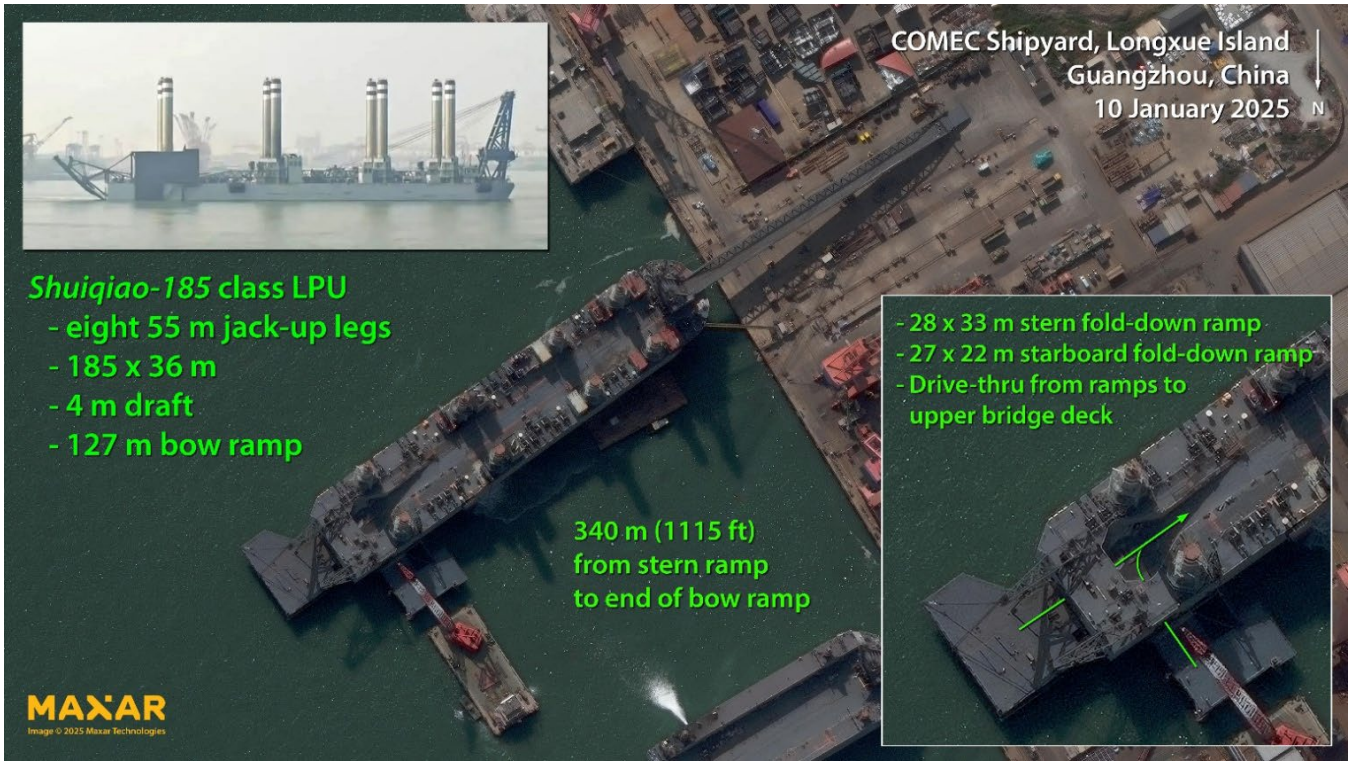
COMEC Shipyard, Longxue Island
Guangzhou, China
10 January 2025
N
Shuiqiao-185 class LPU
- eight 55 m jack-up legs
- 185 x 36 m
- 4 m draft
- 127 m bow ramp
340 m (1115 ft)
from stern ramp
to end of bow ramp
- 28 x 33 m stern fold-down ramp
- 27 x 22 m starboard fold-down ramp
- Drive-thru from ramps to
upper bridge deck
MAXAR
Image © 2025 Maxar Technologies

Figure 9. *Shuiqiao-185* Class LPU, 10 January 2025 (© 2025 Maxar Technologies)[32]

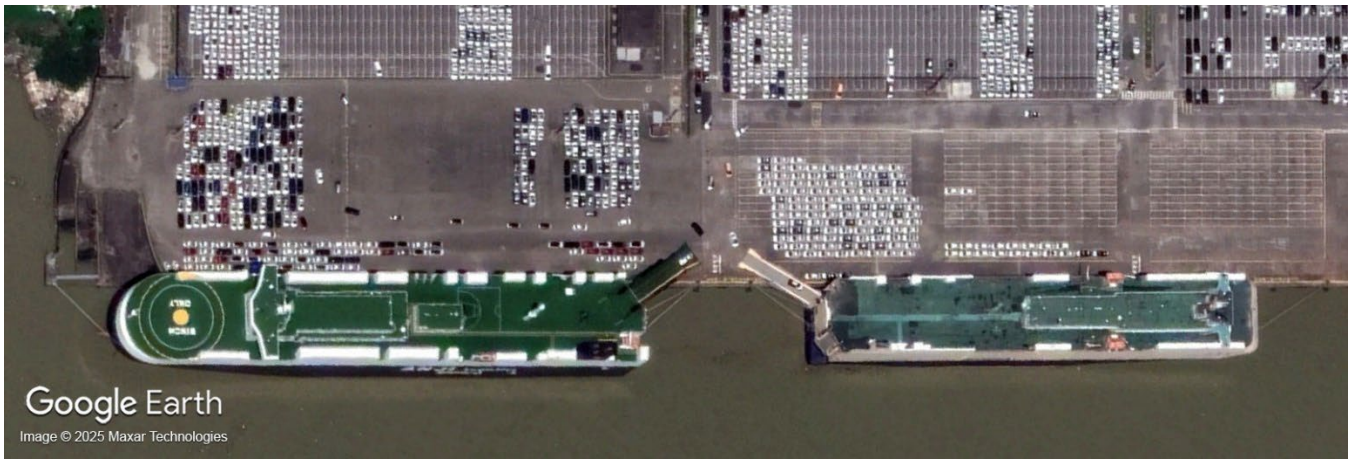

Figure 10. Examples of Large RO-RO Vehicle Carriers with Angled Vehicle Ramps (© 2025 Google Earth/Maxar)[33]

As of early March 2025, the first three *Shuiqiao* LPUs had departed the COMEC shipyard on Longxue Island. Three additional LPUs, a *Shuiqiao-110*, *-135* and *-185*, are still under construction at the shipyard (Figures 11 and 12).

Figure 11. *Shuiqiao-135* and *Shuiqiao-110* Class LPUs Under Construction, 10 January 2025 (© 2025 Maxar Technologies)[34]

Figure 12. *Shuiqiao-185* Class LPU Under Construction, 10 January 2025 (© 2025 Maxar Technologies)[35]

Operational Capabilities

Positioning and Deployment. The *Shuiqiao* LPUs are "jack-up barges" with legs designed to push down into the sea floor and lift the barges out of the water, forming a raised, stable platform that is less subject to the influence of currents or wave action than floating causeways. As observed in March 2025 sea trials, the landing barges form up in a line with the *Shuiqiao-110* taking up position closest to a beach, sea wall, or quay. The medium-sized barge, the *Shuiqiao-135* takes up position approximately 110-120 meters behind the *-110*. The *Shuiqiao-185* takes up position farthest offshore, approximately 110-120 meters behind the *-135*. Figure 13 is a commercial satellite image of the barges preparing to depart their sea trial landing area on 19 March 2025.

Nearshore Operations. Positioning, placement, and disassembly likely take place at high tide, allowing the barges maximum working depth. The bridges have been retracted in Figure 13 as the barges are preparing to depart the landing area. This satellite image was taken at 0332 UTC/11:32 local time, approximately 2.5 hours before high tide.[36] The three LPUs were subsequently missing from imagery at 0707 UTC/15:07 local time, less than four hours later.[37] The landing barges probably departed at high tide during slack water, when tidal currents were minimal.

During placement, as the jack-up legs are cranked down into the sea floor to lift the barges out of the water, the barges flood their ballast tanks to make themselves heavier to ensure their jack-up legs are pressed firmly into the seabed. Once the barges are stabilized and their hulls are above the wave action, 125–130-meter Bailey trestle bridges are extended to connect the barges to each other or, in the case of the *Shuiqiao-110*, to the shore. Together the three landing barges form an 820-meter (2690 foot) relocatable pier for offloading vehicles from civilian and military RO-RO vessels.

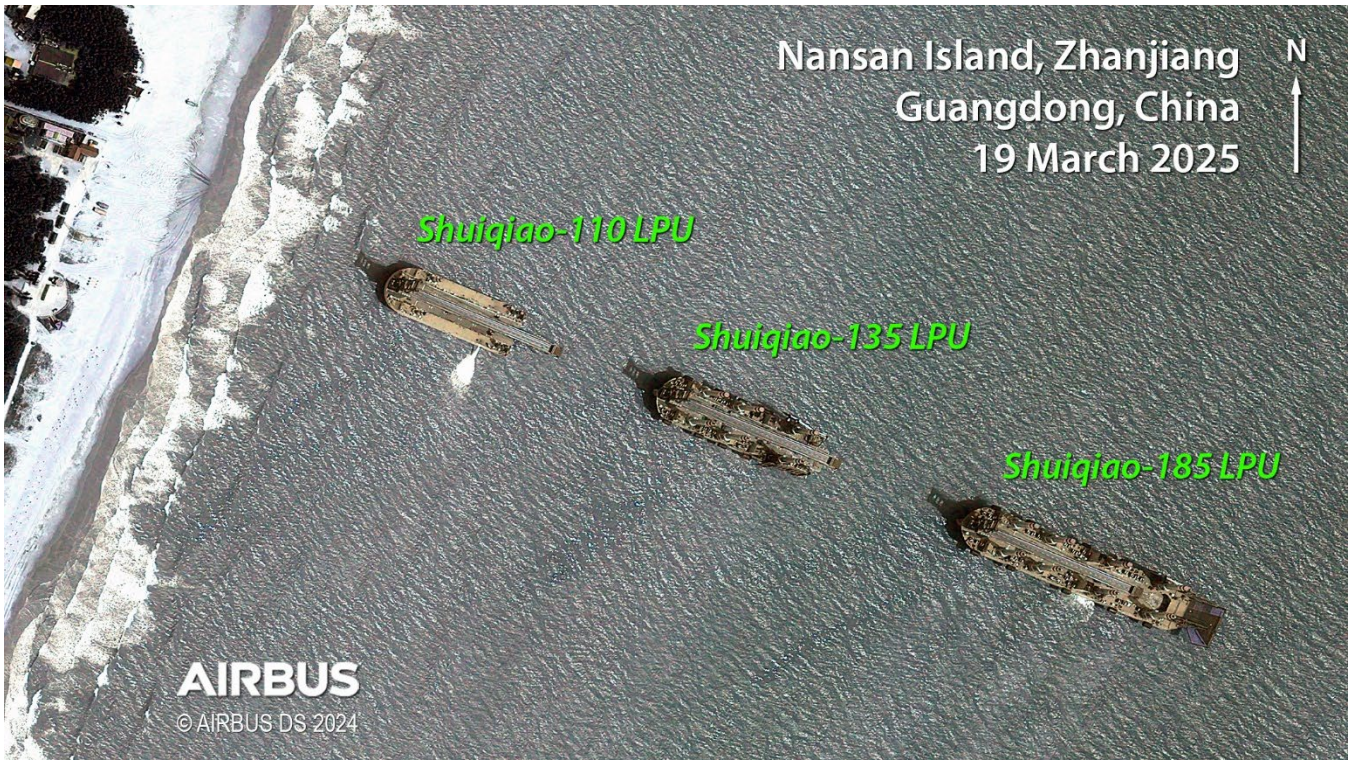

Figure 13. *Shuiqiao* LPUs Preparing to Depart Landing Area Near Zhanjiang, China, 19 March 2025 (© 2025 Airbus)[38]

Operating Depths. During March 2025 sea trials, the barges were positioned in relatively shallow water. According to available nautical charts, mean lower low water (MLLW) level at the LPU's landing location ranged from 0.7 to 3.6 meters.[39] Therefore, during the two weeks the LPUs operated in this area, the *Shuiqiao-110* was positioned in waters ~1.5 meters (5 feet) deep at low tide and ~3 meters (10 feet) deep at high tide. The *Shuiqiao-185*, at the end of the temporary pier, was positioned in waters ~5 meters (16 feet) deep at low tide and ~6.5 meters (21 feet) deep at high tide.

The LPUs are designed to operate in much deeper water. LPU design characteristics, including estimated maximum leg extension below the landing barges, appear in Table 1.

Table 1. *Shuiqiao* LPU Design Characteristics

Class	Jack-up Legs	Est. Max Leg Extension	Length x Width	Draft	Overall Length w/ Bow Ramps	RO-RO Docking Points
Shuiqiao-110	4 @ 32 m (105 ft)	18-20 m (60-66 ft)	110 x 38 m (361 x 125 ft)	2 m (6.5 ft)	240 m (787 ft)	0
Shuiqiao-135	6 @ 50 m (164 ft)	30-32 m (98-105 ft)	135 x 36 m (443 x 118 ft)	4 m (13 ft)	260 m (853 ft)	2
Shuiqiao-185	8 @ 55 m (180 ft)	30-32 m (98-105 ft)	185 x 36 m (607 x 118 ft)	4 m (13 ft)	340 m (1115 ft)	3
Total pier length (assuming 10 m ramp overlap between barges)					**820 m (2690 ft)**	**5**

The different LPU jack-up leg lengths were identified prior to installation at the COMEC shipyard and measured using commercial satellite imagery. The leg extension depth is estimated in Table 1 based on

the assessed height of the different LPU hulls, and how much of the leg may need to remain in the barge and jacking mechanism. The *Shuiqiao* LPU jack-up legs likely have "spudcans" that may add 2-3 meters to operating depths. Spudcans are large, inverted cones mounted on the end of the jack-up leg that press into the sea floor for stability. Maximum operating depth will ultimately be determined by factors such as wave height and tidal range. For example, given 3-meter waves and a 5-meter-high tide, the bottom of an LPU's hull should be more than 8 meters above the low tide water level. In this example, the larger *Shuiqiao* LPUs could probably deploy in 22-24 meters (72-79 feet) of water at low tide. Higher seas and greater tidal ranges would further reduce LPU deployment depths.

Seaworthiness. The patented Harzone designed landing barge that was referenced earlier claimed a capability to set up and connect with other barges in sea state 3 (slight waves ranging from 0.5-1.25 meters / 2-4 feet). However, that original design was about half to two-thirds the size of the *Shuiqiao* LPUs.[40] The newly constructed landing barges may have a capability to set up in higher sea states and endure substantial sea states once set up. However, sea state 3 may still represent the upper range of offloading operations due to the relative motion of vessels trying to dock with the anchored LPUs. The PLA could mitigate the effects of wave action around an LPU pier by sinking ships, containers, or other material to effectively create breakwaters and makeshift harbors.[41]

Capacity. Assuming sufficient water depth and relatively calm sea state alongside a *Shuiqiao-135* and *Shuiqiao-185*, the two LPUs and their four ramps likely offer five offload points—two ships abreast each LPU and an additional ship directly aft of the *Shuiqiao-185*. The *Shuiqiao* LPUs appear to be optimized for offloading vehicles ranging from small tactical vehicles and trucks to 50-ton tanks and other oversized military equipment. The LPUs may also incorporate piping under their bridges that could facilitate the offload and transfer of fuel and fresh water to a landing area, though there are no outward indications that this capability currently exists.

To the question of how many sets of LPUs the PLA may need to support a successful invasion of Taiwan, the answer is a somewhat unsatisfying, "It depends." The number of offload points—five—can accommodate ships ranging in size from large vehicle carriers that might carry hundreds of military vehicles, to sea-going RO-RO ferries, to smaller deck cargo ships that only carry a few dozen trucks. The limiting factor for LPU offload capacity is likely the relatively narrow bridges, which appear to be 6 meters (20 feet) wide. The bridges probably only allow a single column of military vehicles to cross in one direction at a time.[42] A single heavy combined arms battalion of 150 vehicles would likely need a minimum of 30 minutes to offload from a RO-RO ship using the LPU temporary pier. 40-60 minutes is probably a more realistic time.[43] LPU advantages include their ability stay in place and available for days or weeks at a time or relocate to different landing areas based on threat or operational requirements.

Vulnerabilities and Challenges. Beyond the beaches in Taiwan currently assessed as likely amphibious invasion beaches, *Shuiqiao* LPUs may afford the PLA the capability to land in a number of additional locations to deploy second echelon forces and logistics. That said, wherever the LPU temporary pier system is set up as an "amphibious landing base"—a transportation and projection hub—would likely need to be a relatively secure location. The LPUs appear vulnerable to attacks from land, air, and sea.[44] This includes underwater mines in the surf zone, which would have to be cleared before any LPU landing. If a *Shuiqiao-110* were damaged or destroyed, for example, that might neutralize the landing capability of the entire three-LPU composite pier system.

While the *Shuiqiao* LPU temporary pier system solves a critical requirement for PLA over-the-shore logistics in terms of throughput, the increased offloading capability may create its own challenges unique to the Taiwan operating environment. With a newfound capability to offload more personnel, equipment, and materiel faster, the PLA may have created a throughput problem for itself, in that the challenge may no longer be getting things onto the beach or into a port. The challenge may now be getting those same things out quickly enough to make room for more personnel, equipment and materiel.

Russia's ill-fated invasion of Ukraine in February 2022 offers the PLA a cautionary tale. Ten Russian tactical battalions found themselves immobilized in a 35-mile traffic jam, as Ukrainian forces and muddy, unnavigable terrain funneled the Russian invasion force onto just a few viable roads that led to the Ukrainian capital, Kiev.[45] There is relatively little space adjacent to many of Taiwan's beaches to assemble and organize a large invading force. Arriving forces may need to depart as soon as possible to make room for follow-on forces. Taiwan's mountainous terrain, tunnels, and bridges leave the PLA with few viable routes to Taiwan's capital, Taipei, and will potentially funnel the PLA into intersecting fields of fire from Taiwan defenders. Exercises pushing a substantial volume of forces and logistics through landing beaches and ports have not previously been observed in open-source intelligence. Such exercises may be a key future indicator of PLA preparations for a cross-strait invasion.

Conclusion & Implications

These are early days for the *Shuiqiao* LPUs, and there is much to learn about their capabilities and limitations. The PLA will probably put the *Shuiqiao*-class LPUs to the test in 2025 amphibious landing exercises. These exercises typically increase in size and complexity beginning in the early-summer months and peak with large, multi-day exercises in September and October that involve PLA Navy amphibious ships, civilian RO-RO and cargo ships, and PLAA amphibious forces, as well as non-swimming support forces and second echelon forces such as heavy combined arms brigades.

The first three *Shuiqiao* LPUs remain in sea trials and are probably not fully operational as of mid-March 2025. The Zhanjiang bureau of the Maritime Security Administration (MSA) issued a notice of the LPU sea trials off Nansan Island, southeast Zhanjiang from 3 to 11 March 2025.[46] Notification of sea trials indicate the LPUs may not have been accepted by the PLA Navy from the shipyard yet. Interestingly, the LPUs overstayed the sea trial warning period and finally departed the closure area on 19 March. As of 20 March 2025, the three LPUs were located 18 kilometers (10 nautical miles) southwest of the sea trial landing site, just east of Donghai Island.[47] It is unclear as of this writing whether the LPUs are still engaged in sea trials or will return to the Nansan Island beach landing area.

Where the LPUs will ultimately be homeported is also currently unknown, but there are many small bases and PLA Navy outposts dotting China's east coast that may accommodate these shallow draft vessels. The PLA has been quietly making substantial improvements to its basing infrastructure that have largely gone unreported. These include improvements to pier infrastructure at the PLA Navy's 3rd Landing Ship Dadui at Yueqing Bay. In January 2024, the 5th Landing Ship Flotilla occupied a massive new amphibious base along the Yangtze River near Shanghai. As of March 2025, the 6th Landing Ship Flotilla was probably also building a new 1000-meter dock at the southern end of the Zhanjiang Naval Base (Figure 14). These amphibious bases could also be home port candidates for the new LPUs.

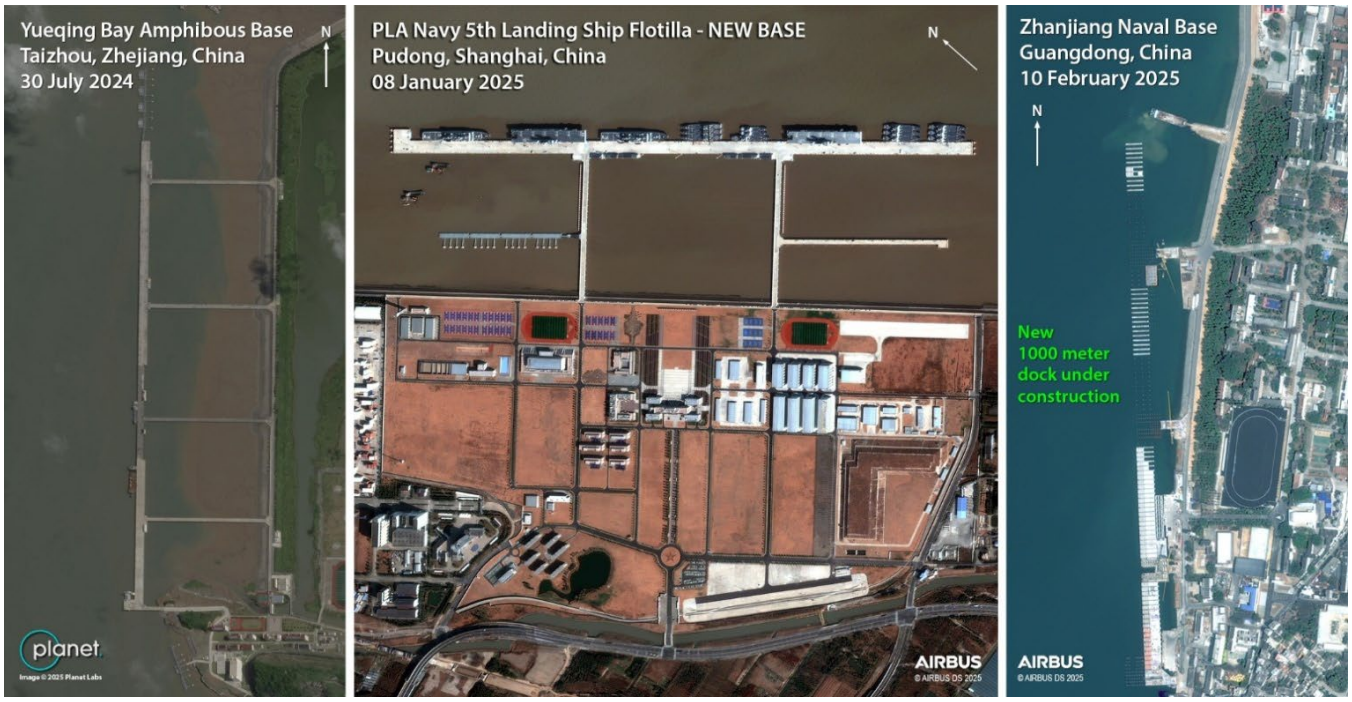

Figure 14. PLA Navy Bases at Yueqing Bay, Pudong, and Zhanjiang (© 2025 Planet Labs, © 2025 Airbus)[48]

The new *Shuiqiao* LPUs offer the PLA a critical capability and fulfill a long-sought requirement to reliably deliver a large volume of second echelon forces into amphibious landing areas. In the context of other developments that include improvements to amphibious base infrastructure, the increased use of a diverse array of civilian vessels to support amphibious operations, and other PLA capability developments, the *Shuiqiao* LPUs are another example of the PLA significantly increasing capabilities to conduct a large-scale cross-strait operation—if they are ordered to do so—in coming years.

The views expressed or implied in this paper are solely those of the authors and do not necessarily represent the views of the U.S. Naval War College, the Department of the Navy, the Department of Defense, or other affiliated organizations.

End Notes

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[6] "COMEC" stands for the original name of this corporation, CSSC Offshore & Marine Engineering (Group) Company, which remains the official English translation, despite the fact that the Chinese name is now "中船海洋与防务装备股份有限公司," CSSC Offshore & Defense Equipment Co., Ltd. COMEC acquired Guangzhou Shipyard International (GSI) in 2015. The shipyard imaged in this report is often still referred to as "Guangzhou Shipyard International" or "GSI Shipyard."

[7] See Andrew S. Erickson, "Shuiqiao Bridge Barges Expand & Extend PRC Amphibious Landing Capabilities, Threatening Taiwan (Updated)," *andrewerickson.com*, 13 March 2025, https://www.andrewerickson.com/2025/03/shuiqiao-bridge-barges-expand-extend-prc-amphibious-landing-capabilities-threatening-taiwan/.

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[43] In previous PLA logistics exercises, RO-RO ferries have transported a single heavy combined arms battalion consisting of approximately 150 vehicles. See Dahm, "More Chinese Ferry Tales," 14-27. Maintaining a perfect one-vehicle-length separation, the battalion would form a 2,400 meter (7,874 foot) single file column. Assuming a maximum speed of 8

kilometers per hour (5 miles per hour) across the Bailey bridges, it would take approximately 24 minutes for the entire battalion to transit the length of the 800-meter pier.

[44] Ukrainian military use of difficult-to-detect uncrewed surface vehicles packed with explosives used to great effect against Russian Black Sea Fleet ships is just one example of the emerging asymmetric threats facing the *Shuiqiao* LPUs and other nearshore PLA capabilities.

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Sources and Methods

This report features commercial satellite imagery from Maxar Technologies, Airbus Intelligence, and Planet Labs. The authors purchased Maxar Technologies WorldView (GSD ~0.15 meters), Airbus Pleiades NEO (GSD ~0.3 meters), Airbus Pleiades (GSD ~0.5 meters), and Planet SkySat (GSD ~0.5) images through SkyWatch Space Applications Inc. The authors are responsible for all annotations of satellite images contained in this report. Maxar, Airbus, and Planet retain copyrights to the underlying satellite images. Copyrighted satellite images in this report should not be reproduced without the expressed permission of the copyright holders. Google Earth images are attributed to the commercial satellite provider and published under the Google Earth terms of service.